

Notice of Allowability

Application No.

10/733,526

Examiner

Richard Chan

Applicant(s)

KISHI, TAKAHIKO

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 3/5/07.
2. ☒ The allowed claim(s) is/are 1-27.
3. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) ☒ All b) ☐ Some* c) ☐ None of the:
 1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
 5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
 - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
 - (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO/SB/08),
Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit
of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☐ Interview Summary (PTO-413),
Paper No./Mail Date _____
7. ☒ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____

EXAMINER'S AMENDMENT

1. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

2. Authorization for this examiner's amendment was given in a telephone interview with John Gallagher (#47,234) on 5/11/07.

3.

The application has been amended as follows:

1. (Currently Amended) A numerical control oscillator comprising: a phase accumulator for accumulating input phase difference data to generate phase data, said phase accumulator including a register for storing and outputting said phase data, and a calculator for one of adding and subtracting said input phase difference data and said phase data from said register; and a memory for storing a phase/amplitude conversion table to output amplitude data corresponding to said phase data generated by said phase accumulator, said numerical control oscillator outputting a signal of a sampling frequency F_s , wherein: if an upper limit of a desired frequency setting interval of an output signal is F_D and, K and L are arbitrary integers, said calculator of said phase accumulator is ~~performs~~ performing one of adding and subtracting said input phase difference data and said phase data from said register by a modulo operation taking a

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nearest integer of M as a modulus, where $M = F_s/FD \times K/L$; and said phase/amplitude conversion table outputs a signal set to a frequency setting interval of a dF step, where $dF = FD/K \times L$.

Allowable Subject Matter

4. The following is an examiner's statement of reasons for allowance:

With respect to claim 1, Camanga Fig.4 discloses the numerical control oscillator 104 comprising: a phase accumulator 106 for accumulating input phase difference data to generate phase data, said phase accumulator 106 including a register for storing and outputting said phase data, and a calculator 108 for one of adding and subtracting said input phase difference data and said phase data from said register; (Col.5 lines 15-26) and a memory 114 for storing a phase/amplitude conversion table 116 to output amplitude data corresponding to said phase data generated by said phase accumulator 106; said numerical control oscillator 104 outputting a signal of a sampling frequency F_s , wherein: if an upper limit of a desired frequency setting interval of an output signal is FD and, K and L are arbitrary integers, said calculator 108 of said phase accumulator 106 is performs one of adding and subtracting said input phase difference data and said phase data from said register.

However the prior art does not specifically disclose wherein the a modulo operation taking a nearest integer of M as a modulus, where $M = F_s/FD \times K/L$; and

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said phase/amplitude conversion table outputs a signal set to a frequency setting interval of a dF step, where $dF = FD/K \cdot L$.

With respect to claims 2 and 9, Oesch discloses the digital down-converter comprising a frequency converter 7, the frequency converter including a numerical control oscillator 34 as a local oscillator and serving to frequency-convert an input signal 2 sampled at a sampling frequency F_s , said digital down-converter converting with mixers 20 and 22 and outputting said input signal 2 into an output signal with a frequency lower than that of said input signal,

However Oesch does not specifically disclose a numerical control oscillator having: a phase accumulator for accumulating input phase difference data to generate phase data, said phase accumulator including a register for storing and outputting said phase data, and a calculator for one of adding and subtracting said input phase difference data and said phase data from said register; and a memory for storing a phase/amplitude conversion table to output amplitude data corresponding to said phase data generated by said phase accumulator, said numerical control oscillator outputting a signal of the sampling frequency F_s , wherein, if a desired frequency setting interval of said input signal is FD and K and L are arbitrary integers, said frequency converter is adapted to frequency-convert said input signal using a specific signal output from said local oscillator and set to a frequency setting interval of a dF step, where $dF = FD/K \cdot L$, said local oscillator outputting the specific signal by accumulating said

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phase difference data by a modulo operation taking a nearest integer of M as a modulus, where $M = F_s / F_D \cdot K / L$.

The Camnga reference however discloses a numerical control oscillator 104 having: a phase accumulator 106 for accumulating input phase difference data to generate phase data, said phase accumulator including a register 114 for storing and outputting said phase data, and a calculator 108 for one of adding and subtracting said input phase difference data and said phase data from said register.

However the prior art does not specifically disclose wherein the a modulo operation taking a nearest integer of M as a modulus, where $M = F_s / F_D \cdot K / L$; and said phase/amplitude conversion table outputs a signal set to a frequency setting interval of a dF step, where $dF = F_D / K \cdot L$.

With respect to claim 3, the prior art discloses the digital down-converter comprising a first frequency converter, the first frequency converter including a numerical control oscillator as a first local oscillator and serving to frequency-convert an input signal sampled at a sampling frequency F_{s1} , and a second frequency converter, the second frequency converter including an identical numerical control oscillator as included in the first frequency converter as a second local oscillator and serving to secondarily frequency-convert an output signal from said first frequency converter, said digital down-converter converting and outputting said input signal into an output signal with a frequency lower than that of said input signal by two frequency conversions, said numerical control oscillator having: a phase accumulator for accumulating input phase

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difference data to generate phase data, said phase accumulator including a register for storing and outputting said phase data, and a calculator for one of adding and subtracting said input phase difference data and said phase data from said register; and a memory for storing a phase/amplitude conversion table to output amplitude data corresponding to said phase data generated by said phase accumulator, said numerical control oscillator outputting a signal of the sampling frequency, wherein: if a desired frequency setting interval of said input signal is FD and $K1$, $K2$ and $L1$ are arbitrary integers, said first frequency converter is adapted to frequency-convert said input signal using a first specific signal output from said first local oscillator and set to a frequency setting interval of an $FD1$ step, where $FD1 = FD / K1 \cdot L1$, said first local oscillator outputting the first specific signal by accumulating said phase difference data by a modulo operation taking a nearest integer of $M1$ as a modulus, where $M1 = Fs1 / FD \cdot K1 / L1$;

However the prior art fails to disclose said second frequency converter is adapted to, if a sampling frequency of the output signal from said first frequency converter is $Fs2$, frequency-convert said output signal from said first frequency converter using a second specific signal output from said second local oscillator and set to a frequency setting interval of an $FD2$ step, where $FD2 = (FD \bmod FD1) / K2$, said second local oscillator outputting the second specific signal by accumulating said phase difference data by a modulo operation taking a nearest integer of $M2$ as a modulus, where $M2 = Fs2 / (FD \bmod FD1) \cdot K2$.

Claim 4 is dependent on allowable claim 3.

With respect to claim 5, the prior art discloses the digital down-converter comprising a first frequency converter, the first frequency converter including a numerical control oscillator as a first local oscillator and serving to frequency-convert an input signal sampled at a sampling frequency F_{s1} , and a second frequency converter, the second frequency converter including an identical numerical control oscillator as the first frequency converter as a second local oscillator and serving to secondarily frequency-convert an output signal from said first frequency converter, said digital down-converter converting and outputting said input signal into an output signal with a frequency lower than that of said input signal by two frequency conversions, said numerical control oscillator having: a phase accumulator for accumulating input phase difference data to generate phase data, said phase accumulator including a register for storing and outputting said phase data, and a calculator for one of adding and subtracting said input phase difference data and said phase data from said register; and a memory for storing a phase/amplitude conversion table to output amplitude data corresponding to said phase data generated by said phase accumulator, said numerical control oscillator outputting a signal of the sampling frequency, wherein: if a desired frequency setting interval of said input signal is F_D , and K_1 , K_2 and L_1 are arbitrary integers, said first frequency converter is adapted to frequency-convert said input signal using a first specific signal output from said first local oscillator and set to a frequency setting interval of an F_{D1} step, where $F_{D1} = F_D / K_1 \cdot L_1$, said first local oscillator

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outputting the first specific signal by accumulating said phase difference data by a modulo operation taking a nearest integer of $M1$ as a modulus, where

$$M1 = Fs1 / FD \cdot K1 / L1;$$

However the prior art fails to disclose said second frequency converter is adapted to, if a sampling frequency of the output signal from said first frequency converter is $Fs2$, frequency-convert said output signal from said first frequency converter using a second specific signal output from said second local oscillator and set to a frequency setting interval of an $FD2$ step, where $FD2 = (FD1 \bmod FD) / K2$, said second local oscillator outputting the second specific signal by accumulating said phase difference data by a modulo operation taking a nearest integer of $M2$ as a modulus, where $M2 = Fs2 / (FD1 \bmod FD) \cdot K2$.

Claim 6 is dependent on allowable claim 5.

With respect to claim 7, the prior art discloses the digital down-converter comprising a first frequency converter, the first frequency converter including a numerical control oscillator as a first local oscillator and serving to frequency-convert an input signal sampled at a sampling frequency $Fs1$, and a second frequency converter, the second frequency converter including an identical numerical control oscillator as in the first frequency converter as a second local oscillator and serving to secondarily frequency-convert an output signal from said first frequency converter, said digital down-converter converting and outputting said input signal into an output signal with a

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frequency lower than that of said input signal by two frequency conversions, said numerical control oscillator having: a phase accumulator for accumulating input phase difference data to generate phase data, said phase accumulator including a register for storing and outputting said phase data, and a calculator for one of adding and subtracting said input phase difference data and said phase data from said register; and a memory for storing a phase/amplitude conversion table to output amplitude data corresponding to said phase data generated by said phase accumulator, said numerical control oscillator outputting a signal of the sampling frequency, wherein: if a desired frequency setting interval of said input signal is FD and $K1$, $K2$ and $L1$ are arbitrary integers, said first frequency converter is adapted to frequency-convert said input signal using a first specific signal output from said first local oscillator and set to a frequency setting interval of an $FD1$ step, where $FD1 = FD/K1 \cdot L1$, said first local oscillator outputting the first specific signal by accumulating said phase difference data by a modulo operation taking a nearest integer of $M1$ as a modulus, where $M1 = Fs1/FD \cdot K1/L1$;

However the prior art fails to disclose said second frequency converter is adapted to, if a sampling frequency of the output signal from said first frequency converter is $Fs2$, frequency-convert said output signal from said first frequency converter using a second specific signal output from said second local oscillator and set to a frequency setting interval of an $FD2$ step, where $FD2 = FD/K2$, said second local oscillator outputting the second specific signal by accumulating said phase difference

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data by a modulo operation taking a nearest integer of $M2$ as a modulus, where $M2 = Fs2 / FD \cdot K2$.

Claim 9 is dependent on allowable claim 8.

With respect to claim 10, the prior art discloses a digital up-converter comprising a first frequency converter, the first frequency converter including a numerical control oscillator as a first local oscillator and serving to frequency-convert an input signal,

However the prior art does not disclose a second frequency converter, the second frequency converter including an identical numerical control oscillator as included in the first frequency converter as a second local oscillator and serving to secondarily frequency-convert an output signal from said first frequency converter, said digital up-converter performing two frequency conversions to convert said input signal into a signal with a frequency higher than that of said input signal and output the converted signal as an output signal sampled at a sampling frequency $Fs2$, said numerical control oscillator having: a phase accumulator for accumulating input phase difference data to generate phase data, said phase accumulator including a register for storing and outputting said phase data, and a calculator for one of adding and subtracting said input phase difference data and said phase data from said register; and a memory for storing a phase/amplitude conversion table to output amplitude data corresponding to said phase data generated by said phase accumulator, said numerical control oscillator outputting a signal of the sampling frequency, wherein: if a desired

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frequency setting interval of said output signal is FD , and $K1$, $K2$, and $L2$ are arbitrary integers, said second frequency converter is adapted to frequency-convert the output signal from said first frequency converter using a first specific signal output from said second local oscillator and set to a frequency setting interval of an $FD2$ step, where $FD2 = FD / K2 \cdot L2$, said second local oscillator outputting the first specific signal by accumulating said phase difference data by a modulo operation taking a nearest integer of $M2$ as a modulus, where $M2 = Fs2 / FD \cdot K2 / L2$; and said first frequency converter is adapted to, if a sampling frequency of said input signal is $Fs1$, frequency-convert said input signal using a second specific signal output from said first local oscillator and set to a frequency setting interval of an $FD1$ step, where $FD1 = (FD \bmod FD2) / K1$, said first local oscillator outputting the second specific signal by accumulating said phase difference data by a modulo operation taking a nearest integer of $M1$ as a modulus, where $M1 = Fs1 / (FD \bmod FD2) \cdot K1$.

Claim 11 is dependent on allowable claim 10.

With respect to claim 12, the prior art discloses a digital up-converter comprising a first frequency converter, the first frequency converter including a numerical control oscillator as a first local oscillator and serving to frequency-convert an input signal.

However the prior art fails to disclose a second frequency converter, the second frequency converter including an identical numerical control oscillator as included in the first frequency converter as a second local oscillator and serving to secondarily

frequency-convert an output signal from said first frequency converter, said digital up-converter performing two frequency conversions to convert said input signal into a signal with a frequency higher than that of said input signal and output the converted signal as an output signal sampled at a sampling frequency F_{s2} , said numerical control oscillator having: a phase accumulator for accumulating input phase difference data to generate phase data, said phase accumulator including a register for storing and outputting said phase data, and a calculator for one of adding and subtracting said input phase difference data and said phase data from said register; and a memory for storing a phase/amplitude conversion table to output amplitude data corresponding to said phase data generated by said phase accumulator, said numerical control oscillator outputting a signal of the sampling frequency, wherein: if a desired frequency setting interval of said output signal is FD and $K1$, $K2$ and $L2$ are arbitrary integers, said second frequency converter is adapted to frequency-convert the output signal from said first frequency converter using a first specific signal output from said second local oscillator and set to a frequency setting interval of an $FD2$ step, where $FD2 = FD / K2 \cdot L2$, said second local oscillator outputting the first specific signal by accumulating said phase difference data by a modulo operation taking a nearest integer of $M2$ as a modulus, where $M2 = F_{s2} / FD \cdot K2 / L2$; and said first frequency converter is adapted to, if a sampling frequency of said input signal is F_{s1} , frequency-convert said input signal using a second specific signal output from said first local oscillator and set to a frequency setting interval of an $FD1$ step, where $FD1 = (FD2 \bmod FD) / K1$, said first local oscillator outputting the second specific signal by accumulating said phase difference data by a

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modulo operation taking a nearest integer of $M1$ as a modulus, where $M1 = Fs1 / (FD2 \bmod FD) \cdot K1$.

Claim 13 is dependent on allowable claim 12.

With respect to claim 14, the prior art discloses a digital up-converter comprising a first frequency converter, the first frequency converter including a numerical control oscillator as a first local oscillator and serving to frequency-convert an input signal, and a second frequency converter.

However the prior art fails to disclose the second frequency converter including an identical numerical control oscillator as included in the first frequency converter as a second local oscillator and serving to secondarily frequency-convert an output signal from said first frequency converter, said digital up-converter performing two frequency conversions to convert said input signal into a signal with a frequency higher than that of said input signal and output the converted signal as an output signal sampled at a sampling frequency $Fs2$, said numerical control oscillator having: a phase accumulator for accumulating input phase difference data to generate phase data, said phase accumulator including a register for storing and outputting said phase data, and a calculator for one of adding and subtracting said input phase difference data and said phase data from said register; and a memory for storing a phase/amplitude conversion table to output amplitude data corresponding to said phase data generated by said phase accumulator, said numerical control oscillator outputting a signal of the sampling

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frequency, wherein: if a desired frequency setting interval of said output signal is FD and $K1$, $K2$ and $L2$ are arbitrary integers, said second frequency converter is adapted to frequency-convert the output signal from said first frequency converter using a first specific signal output from said second local oscillator and set to a frequency setting interval of an $FD2$ step, where $FD2 = FD / (K2 \cdot L2)$, said second local oscillator outputting the first specific signal by accumulating said phase difference data by a modulo operation taking a nearest integer of $M2$ as a modulus, where $M2 = F_{s2} / (FD \cdot K2 / L2)$; and said first frequency converter is adapted to, if a sampling frequency of said input signal is F_{s1} , frequency-convert said input signal using a second specific signal output from said first local oscillator and set to a frequency setting interval of an $FD1$ step, where $FD1 = FD / K1$, said first local oscillator outputting the second specific signal by accumulating said phase difference data by a modulo operation taking a nearest integer of $M1$ as a modulus, where $M1 = F_{s1} / (FD \cdot K1)$.

Claim 15 is dependent on allowable claim 14.

With respect to claim 16, the prior art discloses a receiver comprising a first frequency converter, the first frequency converter including a first local oscillator and serving to frequency-convert a received signal, said first local oscillator including a numerical control oscillator operating at a sampling frequency F_s and a phase locked loop (PLL) circuit having a multiplication ratio P (P is an integer) and acting to receive the output signal from the numerical control oscillator as a reference signal.

However the prior art fails to disclose a second frequency converter, the second frequency converter including an identical numerical control oscillator as included in the first local oscillator as a second local oscillator and serving to secondarily frequency-convert an output signal from said first frequency converter, and a demodulator for demodulating an output signal from said second frequency converter to extract received data therefrom, said receiver converting said received signal into a baseband received signal with a frequency lower than that of said received signal by two frequency conversions and extracting the received data from the converted baseband received signal, said numerical control oscillator having: a phase accumulator for accumulating input phase difference data to generate phase data, said phase accumulator including a register for storing and outputting said phase data, and a calculator for one of adding and subtracting said input phase difference data and said phase data from said register; and a memory for storing a phase/amplitude conversion table to output amplitude data corresponding to said phase data generated by said phase accumulator, said numerical control oscillator outputting a signal of the sampling frequency, wherein: if a desired frequency setting interval of said received signal is FD and $K1$, $K2$ and $L1$ are arbitrary integers, said first frequency converter is adapted to frequency-convert said received signal using a first specific signal output from said first local oscillator and set to a frequency setting interval of an FDP step, where $FDP = FD / K1 \cdot L1$, said first local oscillator outputting the first specific signal by accumulating said phase difference data by a modulo operation taking a nearest integer of $M1$ as a modulus, where $M1 = F_s / FD \cdot K1 / L1 \cdot P$; and said second frequency converter is adapted to, if a

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sampling frequency of the output signal from said first frequency converter is F_{s1} , frequency-convert said output signal from said first frequency converter using a second specific signal output from said second local oscillator and set to a frequency setting interval of an $FD2$ step, where $FD2 = (FD \bmod FDP) / K2$, said second local oscillator outputting the second specific signal by accumulating said phase difference data by a modulo operation taking a nearest integer of $M2$ as a modulus, where $M2 = F_{s1} / (FD \bmod FDP) \cdot K2$.

Claim 17 is dependent on allowable claim 16.

With respect to claim 18, the prior art discloses a receiver comprising a first frequency converter including a first local oscillator and serving to frequency-convert a received signal, said first local oscillator including a numerical control oscillator operating at a sampling frequency F_s and a PLL circuit having a multiplication ratio P (P is an integer) and acting to receive the output signal from the numerical control oscillator as a reference signal.

However the prior art does not disclose a second frequency converter including an identical numerical control oscillator as included in the first local oscillator as a second local oscillator and serving to secondarily frequency-convert an output signal from said first frequency converter, and a demodulator for demodulating an output signal from said second frequency converter to extract received data therefrom, said receiver converting said received signal into a baseband received signal with a

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frequency lower than that of said received signal by two frequency conversions and extracting the received data from the converted baseband received signal, said numerical control oscillator having: a phase accumulator for accumulating input phase difference data to generate phase data, said phase accumulator including a register for storing and outputting said phase data, and a calculator for one of adding and subtracting said input phase difference data and said phase data from said register; and a memory for storing a phase/amplitude conversion table to output amplitude data corresponding to said phase data generated by said phase accumulator, said numerical control oscillator outputting a signal of the sampling frequency, wherein: if a desired frequency setting interval of said received signal is FD , and $K1$, $K2$, and $L1$ are arbitrary integers, said first frequency converter is adapted to frequency-convert said received signal using a first specific signal output from said first local oscillator and set to a frequency setting interval of an FDP step, where $FDP = FD / K1 \cdot L1$, said first local oscillator outputting the first specific signal by accumulating said phase difference data by a modulo operation taking a nearest integer of $M1$ as a modulus, where $M1 = F_s / FD \cdot K1 / L1 \cdot P$; and said second frequency converter is adapted to, if a sampling frequency of the output signal from said first frequency converter is $Fs1$, frequency-convert said output signal from said first frequency converter using a second specific signal output from said second local oscillator and set to a frequency setting interval of an $FD2$ step, where $FD2 = (FDP \bmod FD) / K2$, said second local oscillator outputting the second specific signal by accumulating said phase difference data by a modulo operation taking a nearest integer of $M2$ as a modulus, where $M2 = Fs1 / (FDP$

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mod FD).times.K2.

Claim 19 is dependent on allowable claim 18.

With respect to claim 20, the prior art discloses a receiver comprising a first frequency converter including a first local oscillator and serving to frequency-convert a received signal, said first local oscillator including a numerical control oscillator operating at a sampling frequency F_s and a PLL circuit having a multiplication ratio P (P is an integer) and acting to receive the output signal from the numerical control oscillator as a reference signal.

However the prior art fails to disclose a second frequency converter including an identical numerical control oscillator as included in the first local oscillator as a second local oscillator and serving to secondarily frequency-convert an output signal from said first frequency converter, and a demodulator for demodulating an output signal from said second frequency converter to extract received data therefrom, said receiver converting said received signal into a baseband received signal with a frequency lower than that of said received signal by two frequency conversions and extracting the received data from the converted baseband received signal, said numerical control oscillator having: a phase accumulator for accumulating input phase difference data to generate phase data, said phase accumulator including a register for storing and outputting said phase data, and a calculator for one of adding and subtracting said input phase difference data and said phase data from said register; and a memory for storing

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a phase/amplitude conversion table to output amplitude data corresponding to said phase data generated by said phase accumulator, said numerical control oscillator outputting a signal of the sampling frequency, wherein: if a desired frequency setting interval of said received signal is FD , and $K1$, $K2$, and $L1$ are arbitrary integers, said first frequency converter is adapted to frequency-convert said received signal using a first specific signal output from said first local oscillator and set to a frequency setting interval of an FDP step, where $FDP = FD/K1 \cdot L1$, said first local oscillator outputting the first specific signal by accumulating said phase difference data by a modulo operation taking a nearest integer of $M1$ as a modulus, where $M1 = Fs/FD \cdot K1/L1 \cdot P$; and said second frequency converter is adapted to, if a sampling frequency of the output signal from said first frequency converter is $Fs1$, frequency-convert said output signal from said first frequency converter using a second specific signal output from said second local oscillator and set to a frequency setting interval of an $FD2$ step, where $FD2 = FD/K2$, said second local oscillator outputting the second specific signal by accumulating said phase difference data by a modulo operation taking a nearest integer of $M2$ as a modulus, where $M2 = Fs1/FD \cdot K2$.

Claim 21 is dependent on allowable claim 20.

With respect to claim 22, the prior art discloses a transmitter comprising a modulator for modulating and outputting a baseband transmit signal based on transmit

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data, a first frequency converter including a numerical control oscillator as a first local oscillator and serving to frequency-convert the output signal from said modulator.

However the prior art fails to disclose a second frequency converter including a second local oscillator and serving to secondarily frequency-convert an output signal from said first frequency converter, said second local oscillator including an identical numerical control oscillator as included in the first frequency converter operating at a sampling frequency F_s and a PLL circuit having a multiplication ratio P (P is an integer) and acting to receive the output signal from the numerical control oscillator as a reference signal, said transmitter converting and outputting said baseband transmit signal into a transmit signal with a frequency higher than that of said baseband transmit signal by two frequency conversions, said numerical control oscillator having: a phase accumulator for accumulating input phase difference data to generate phase data, said phase accumulator including a register for storing and outputting said phase data, and a calculator for one of adding and subtracting said input phase difference data and said phase data from said register; and a memory for storing a phase/amplitude conversion table to output amplitude data corresponding to said phase data generated by said phase accumulator, said numerical control oscillator outputting a signal of the sampling frequency, wherein: if a desired frequency setting interval of said transmit signal is F_D , and K_1 , K_2 , and L_2 are arbitrary integers, said second frequency converter is adapted to frequency-convert the output signal from said first frequency converter using a first specific signal output from said second local oscillator and set to a frequency setting interval of an F_{DP} step, where $F_{DP} = F_D / K_2 \cdot L_2$, said second local oscillator

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outputting the first specific signal by accumulating said phase difference data by a modulo operation taking a nearest integer of $M2$ as a modulus, where $M2 = F_s / F_D \cdot K_2 / L_2 \cdot P$; and said first frequency converter is adapted to, if a sampling frequency of the output signal from said modulator is F_{s1} , frequency-convert said output signal from said modulator using a second specific signal output from said first local oscillator and set to a frequency setting interval of an F_{D1} step, where $F_{D1} = (F_D \bmod F_{DP}) / K_1$, said first local oscillator outputting the second specific signal by accumulating said phase difference data by a modulo operation taking a nearest integer of $M1$ as a modulus, where $M1 = F_{s1} / (F_D \bmod F_{DP}) \cdot K_1$.

Claim 23 is dependent on allowable claim 22.

With respect to claim 24, the prior art discloses a transmitter comprising a modulator for modulating and outputting a baseband transmit signal based on transmit data, a first frequency converter including a numerical control oscillator as a first local oscillator and serving to frequency-convert the output signal from said modulator.

However the prior art fails to disclose a second frequency converter including a second local oscillator and serving to secondarily frequency-convert an output signal from said first frequency converter, said second local oscillator including an identical numerical control oscillator as included in the first frequency converter operating at a sampling frequency F_s and a PLL circuit having a multiplication ratio P (P is an integer) and acting to receive the output signal from the numerical control oscillator as a

reference signal, said transmitter converting and outputting said baseband transmit signal into a transmit signal with a frequency higher than that of said baseband transmit signal by two frequency conversions, said numerical control oscillator having: a phase accumulator for accumulating input phase difference data to generate phase data, said phase accumulator including a register for storing and outputting said phase data, and a calculator for one of adding and subtracting said input phase difference data and said phase data from said register; and a memory for storing a phase/amplitude conversion table to output amplitude data corresponding to said phase data generated by said phase accumulator, said numerical control oscillator outputting a signal of the sampling frequency, wherein: if a desired frequency setting interval of said transmit signal is FD , and $K1$, $K2$, and $L2$ are arbitrary integers, said second frequency converter is adapted to frequency-convert the output signal from said first frequency converter using a first specific signal output from said second local oscillator and set to a frequency setting interval of an FDP step, where $FDP = FD / K2 \cdot L2$, said second local oscillator outputting the first specific signal by accumulating said phase difference data by a modulo operation taking a nearest integer of $M2$ as a modulus, where $M2 = Fs / FD \cdot K2 / L2 \cdot P$; and said first frequency converter is adapted to, if a sampling frequency of the output signal from said modulator is $Fs1$, frequency-convert said output signal from said modulator using a second specific signal output from said first local oscillator and set to a frequency setting interval of an $FD1$ step, where $FD1 = (FDP \bmod FD) / K1$, said first local oscillator outputting the second specific signal by accumulating said phase difference data by a modulo operation taking a nearest integer

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of $M1$ as a modulus, where $M1 = Fs1 / (FDP \bmod FD) \cdot K1$.

Claim 25 is dependent on allowable claim 24.

With respect to claim 26, the prior art discloses a transmitter comprising a modulator for modulating and outputting a baseband transmit signal based on transmit data, a first frequency converter including a numerical control oscillator as a first local oscillator and serving to frequency-convert the output signal from said modulator.

However the prior art does not disclose wherein a second frequency converter including a second local oscillator and serving to secondarily frequency-convert an output signal from said first frequency converter, said second local oscillator including an identical numerical control oscillator as included in the first frequency converter operating at a sampling frequency F_s and a PLL circuit having a multiplication ratio P , where P is an integer, and acting to receive the output signal from the numerical control oscillator of claim 1 as a reference signal, said transmitter converting and outputting said baseband transmit signal into a transmit signal with a frequency higher than that of said baseband transmit signal by two frequency conversions, wherein: if a desired frequency setting interval of said transmit signal is FD , and $K1$, $K2$, and $L2$ are arbitrary integers, said second frequency converter is adapted to frequency-convert the output signal from said first frequency converter using a first specific signal output from said second local oscillator and set to a frequency setting interval of an FDP step, where $FDP = FD / K2 \cdot L2$, said second local oscillator outputting the first specific signal by

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accumulating said phase difference data by a modulo operation taking a nearest integer of $M2$ as a modulus, where $M2 = F_s / F_D \cdot K2 / L2 \cdot P$; and said first frequency converter is adapted to, if a sampling frequency of the output signal from said modulator is F_{s1} , frequency-convert said output signal from said modulator using a second specific signal output from said first local oscillator and set to a frequency setting interval of an $FD1$ step, where $FD1 = FD / K1$, said first local oscillator outputting the second specific signal by accumulating said phase difference data by a modulo operation taking a nearest integer of $M1$ as a modulus, where $M1 = F_{s1} / F_D \cdot K1$.

Claim 27 is dependent on allowable claim 26.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

The Ahn reference (US 6,671,339) discloses a lock detecting apparatus and method for multimedia digital broadcasting receiver.

The Chiu reference (US 6,781,473) discloses a High speed low power implementation for multi-channel numerically controlled oscillator.

5. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably

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accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Richard Chan whose telephone number is (571) 272-0570. The examiner can normally be reached on Mon - Fri (9AM - 5PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nay Maung can be reached on (571)272-7882. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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5/21/07




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